2.0 REVIEW OF LITERATURE

A perusal of literature shows the following works done on the plants viz. *Dalbergia sissoo* (Roxb.), heart wood; *Cassia fistula* (Linn) whole plant, *Cissus quadrangularis* (Linn), *Clitoria ternatea* (Linn) and *Amorphophyllus campanulatus* for anthelmintic activity with different parts throughout the world.

2.1 LITERATURE REVIEW OF *DALBERGIA SISSOO* (ROXB)

Studies were carried out on some essential oils obtained from the leaves, for their antifungal activities of *Abutilon indicum, Bothriochloa pertusa, Murya exotica* & *Dalbergia sissoo*. The oils of *Abutilon indicum, Bothriochloa pertusa* have been found to be effective whereas oily of *Murya exotica & Dalbergia sissoo* have been found to be ineffective against tested organisms. (Jain, P.K., et al., 1979)

Isolation and structural elucidation of alcohlic extract of the mature pods of *Dalbergia sissoo*, yielded a new isoflavanone glucoside (C$_{31}$H$_{38}$O$_{18}$, m.p. 210°C-214°C) identified as 7-Gentiobioside of 5,7–dihydroxy 6,2,4,5- tetra methoxy flavonons. (Sharma, A., et al., 1979)

Isolation and structural elucidation of a novel isocaviunin (5-7–dihydroxy – 8,2′,4,5′– tetra methoxy isoflavone,(m.p. 193 -194°C) in addition, with tectorigenin, delbergin, bio-chanin A and 7– hydroxyl – 4 – methyl – coumarin, from the air dried mature pods of *Dalbergia sissoo* (Sharma, A, et al., 1980)

Isolation and structural elucidation of alcoholic extract mature pods of *Dalbergia sissoo* resulted in isocavianin–7-O-glucoside (isocaviudin), along with tectorigenin–7-O-glucoside (tectoridin) and caviunin–7–O-glucoside. Structures were identified by spectral analysis and chemical degradation. (Sharma, A., et al., 1980)

From chemical analysis it has shown that presence of oleanolic acid (0.2%), isoliquiritigenin (2′, 4′, 4-tri hydroxy chalcone) (0.1%) and liquiritigen (7,4′-dihydroxy
flavonone) from the heart wood, β-sitosterol (0.1%), latifolin (0.15%) from the sap wood and biochanin-A, kaempferol (0.08%) from the tender leaves of *Dalbergia sissoo*. (Ravi, P., et al., 1990)

From *Dalbergia sissoo* root neoflavonoids such as (S)-4-methoxy dalbergione, (R)-latifolin & dalbergin were isolated & identified. (Gandhidasan, R., et al., 1991)

Studies revealed that alcoholic extracts of *Dalbergia sissoo* was found to be effective during kinin & prostaglandin phases of raw paw edema, which are mediators of inflammation. (Nagarajan, N.S., et al., 1995)

It was reported that a few medicinal plants used as skin care e.g., *Ammi majus*, *Dalbergia sissoo*, *Lausania inermis*, *Tephrene purpurea*, in respect of their chemical constituents and medicinal action. (Kamil, M., 1995)

90% Ethanolic extract of *Dalbergia sissoo*, leaves was studied in different models of inflammation of rats after oral administration at doses of 100, 300 and 1000 mg./kg. Leaf ethanolic extracts showed significant activity against carrageenin, kaolin and nystatin-induced paw oedema model, as well as the weight of granuloma induced by a cotton pellet. It also inhibited dye leakage in acetic acid-induced vascular permeability test in mice. Leaf extract was devoid of ulcerogenic effect on the gastric mucosa of rats in acute and chronic tests. Thus, the *Dalbergia sissoo* leaf extract possessed significant anti-inflammatory activity (in acute, sub-acute and chronic models of inflammation) without any side effect on gastric mucosa. (Hajore, S.W., et al., 2001)

From methylene chloride extract of heart wood of *Dalbergia sissoo*, latifolin was isolated and found to exhibit the inhibition of β-amyloid synthesis as IC50 of 180 µgm. (Ramakrishna, N.V.S., et al., 2001).
2.2 LITERATURE REVIEW OF CASSIA FISTULA (LINN)

Studies were conducted for 6 species of Cassia genera for the presence of amino acids along with Cassia fistula. (Dale,T., et al., 1981)

The neutral fractions, obtained from the methanolic extract of the flowers, were analyzed for sterols in three Cassia species. It revealed the presence of stigmasterol, sitosterol, 24 methyl cholesterol and cholesterol from Cassia siamea; campestral, sitosterol and cycloartenol from Cassia sophera. Stigmasterol, sitosterol and 28-isofucosterol from Cassia fistula. (Ghosh,P., et al. 1982)

From the sapwood of Cassia fistula, isolation and structural elucidation of kaempferol, dihydrokaempferol, (-) epiadzelchin & (+) catechin and 1,8-,dihydroxy-3-methylanthraquinone. In addition, a new dimeric proanthocyanidin has been isolated and its structure was established on the basis of NMR and MS data and degradation by benzylthiol. (Patil,A., et al., 1982)

The extracts of Bridelia retusa (bark), Cassia fistula (bark), Commifora mukkul (whole plant excluding root) appreciably increase the mean survival time (MST) of mice infected intracerebrally with vaccine virus. A positive correlation of antiviral activity of this plant extracts both invivo and invitro has been obtained. (Prasad,C.B., 1983)

Studies carried out employing Cassia fistula in different forms of preparations with single doses for effective treatment. The average time taken for complete cure was 8-13 days. (Nair,C.P.R., 1984)

Scanning Electron Microscope studies of dry ripe seeds of Caesalpinia piniooidea, Cassia fistula, Mimosa pudica, Albizzia lebbek were performed. The ornamentation of each seed is distinct form the other that helps in its identification. (Trivedi,B.S., et al., 1984)
Hexane extract of seed oil of *Cassia abscus* (4.8%), *Cassia fistula* (4.0%) and *Cassia occidentalis* (3.55%) have been studied for the oxidative degradation of their unsaturated fatty acids by von Rudolf’s technique. (Zaka,S., et al., 1986)

The sennoside content of the leaves and pods of *Cassia angustifolia*, *Cassia fistula* and *Cassia holosericea* has been estimated spectrophotometrically. (Yasmin,A., et al., 1987)

Studies revealed that pronthocyanidines containing flavon-3-ol (epiafzelectin & epicatechin) units with an abnormal 2S configuration have been isolated form the pods of *Cassia fistula*. The structures have been established based on spectral analysis & chemical degradation. (Kashiwada,Y., et al., 1990)

Growth and production of anthraquinones by callus cultures derived from the seedling of *Cassia fistula* have been studied. The effect of phytohormones, mineral constituents of basal medium, CNP ratio, maleic hydrazide & light on callus growth and anthraquinones productivity have been examined in detail. (Ahuja.A., et al., 1992)

Chloroform and ethanol extracts of leaves of *Adadhoda vasaka*, *Cassia fistula*, *Prospis juliflor* and Ethanolic extracts of *Allium sativam* showed *invitro* antifungal activity against systemic fungal pathogens. (Malik.J.K., et al., 1991)

Histological studies of the ovary and uterus were undertaken after oral administration of aqueous extracts of the flowers at doses of 100 and 250 mg./kg./day/rat for 15 days. The naked eye observation revealed that no change but when examined histologically, there was an evidence of follicular atresia with the absence of corpus luteum at higher dose. Primary and secondary follicles showed degenerative changes. The primordial oocyte population was also reduced. There were no regressive changes in the uterus of the treated rats. (Singh,S.K, et al., 1992)
Isolation of 7-methyl physcion, betulinic and β-sitosterol form dried roots of *Cassia fistula*. 95% ethanolic extracts of the roots lowered the blood sugar level up to 30% after 2 hr when tested as albino rats. (Vaishnava, M.M., et al., 1993)

Studies were performed on 31 indigenous plant species of India, for their hexane, chloroform, butanol, alcoholic and aqueous extracts, which were screened for their antisecretory activity. The extracts of five plants, *A. paniculata, C. fistula, Coleus forskohlii, T. procumbens, P. somniferum*, showed highly significant activity. (Gupta, S., et al., 1993)

Studies were performed for quantitative microscopic constituents and histological characters, which help in the identification of closely resembling species of genus. Shape & type of marginal trichomes were found to be highly specific in the identification of medicinally important species of genus *Cassia* (*Cassia fistula, Cassia alata, Cassia auriculata, Cassia biflora, Cassia occidentalis* and *Cassia glanta*). (Joshi, M.S., et al., 1993)

Seed powder of *Cassia fistula* was found effective in experimental amoebiasis at the dose of 75 mg./kg./day for 5 days, following the post injection period of 48 hrs. (Anturlika, S.D., et al., 1994)

Methanolic extracts of *Cassia fistula* seeds showed increase of life span and decrease in the tumor volume and viable tumor cell count in the tumor hosts. The results suggested that methanolic extract of seeds has an antitumor activity. (Gupta, M., et al., 2000)

Studies revealed that methanolic extracts of buds showed significant antipyretic activity on yeast – induced pyrexia in rats, at the dose level of 200 & 400 mg/kg compared to the standard of paracetamol. (Bhakta, T., et al., 2001)
Phytochemical screening of various extracts of dried leaves of *Cassia fistula* showed the presence of phytosterols, flavonoids, glycosides, triterpenoids, alkaloids, saponins, tannins and steroids. (Krishnaveni,A., et al., 2004)

Clinical investigation of Joshanan-e-khayar Shamber (Chief ingredient *Cassia fistula*) and Sharbat-e-Toot Siyah (Chief ingredient *Morus Alba*) for chronic tonsillitis was undertaken by Fashhuzzaman, M., et al., 2003.

### 2.3 LITERATURE REVIEW OF *CISSUS QUADRANGULARIS* (LINN)

It was investigated that several features of epidermis, especially in the organization of stomata have been observed in *Cissus quadrangularis*. The abnormal stomata reported are recorded for the first time in Vitaceae family. Pearl glands have also been observed on the growing stems, leaves, tendrils of Cissus. (Janardhan, K., et al., 1982)

Isolation & structural elucidation of two unsymmetrical tetracyclic triterpenoids from *Cissus quadrangularis* onocer-7-ene-3 & 21 β-diol onocer-7 ene-3 β, 21, α-diol together with sitosterol, δ-amyrone & δ-amyrine have been obtained from stems of *Cissus quadrangularis*. Structural elucidation was carried out by spectral analysis & chemical evidences (Bhutani,K.K., et al., 1984)

7 new compounds were isolated & characterized from *Cissus quadrangularis* plant, as 4-hydroxy-2-methyl-tricos-2-en-22-one-9-methyl-octade-9-ene, hepta decyl octa decanoate, icosanyl icosanate, 31-methyl trioctanol, 7-hydroxy-20-oxo-decosanyl cyclo hexane and 31-methyl tri acontanoic acid, taraxeryl acetate, friedelan-3-one, taraxerol & isopenta-cosconic acid were isolated for the first time from this plant. (Gupta,M.M., et al., 1991)

Screening of two herbal preparations namely tulsi (*Ocinum sanctum*) and hem jar (*Cissus quadrangularis*) were used in the management of mandibular fracture.
When in addition on the basic management the Jaw bone fractures, treatment was supplemented with the above drugs, the immobilization significantly.

Studies were carried out for acetone, methanolic extracts of Cissus quadrangularis stem, and leaves administered 20gm/kg orally to male albino rats suppressed carrageen induced oedema. This shows a significant anti-inflammatory activity related to its inhibitory effect on release of histamine, kinin and prostaglandin. (Vetrichelvan., et al., 2000)

Calcium enhancing activity of the herbal formulation containing Cissus quadrangularis, which has been known since ancient times in ayurvedic system of medicine for its beneficial effect in fracture healing, has been investigated in female albino rats. Treatment with above herbal formulation has shown significantly reduced the urinary calcium excretion compared to induced group. Percentage calcium has significant increase compared to the induced group. Histopathological observation of femur bone revealed beneficial effects. Hence administration of the formulation has shown a beneficial effect on cold stress and ovariectomized rat model of osteoporosis (Hedge,P., 2000)

Aqueous and methanolic extracts of nine traditional Zulu medicinal plants including Cissus quadrangularis, all belonging to the Vitaceae family, were evaluated to determine their therapeutic potentials as antineoplastic agents. The antiproliferative activity in invitro against HepG2 cells was determined. 22 of the 27 crude plant extracts showed activities ranging from 25%- 97% inhibition of proliferation when compared with control which showed no inhibitory activity. Higher degrees of growth inhibition were found in aqueous root extracts in comparison with the methanol extracts of same plant parts. The results show potential antineoplastic activity, indicating some scientific validation for traditional usage. (Opoku,A.R., et al., 2001)
Clinical trials were conducted on 60 patients to prove the efficacy of *Cissus quadrangularis* in fracture healing. Fractures of long bones were treated topically with *Cissus quadrangularis* treated patients showed good callus formation in 30-40 % time than the nontreated. (Thavani,N., et al., 2002)

Aqueous (hot & cold) and solvent extracts (acetone, chloroform & methanol) of *Cissus quadrangularis* were screened for activity against *Helicobacter pylori* human isolates. Flowering and vegetative period samples were analyzed. Among them chloroform was observed to recover bioactive principles with low MIC and MLC. MIC concentration was identified at 40µg/ml. Extracts from samples collected during flowering period were better than that of vegetative period. The results confirm the traditional use of the plant in peptic ulcer. (Austin, A., et al., 2003)

*Cissus quadrangularis* is also known as hadjod, asthisamhari commonly used in Indian traditional medicine for bone healing. Recent animal studies and human trials with its extract have been shown promising results in fracture healing and osteoporosis. (Gharpure, K.L., et al., 2004)

Studies revealed that capsule of femnia containing plants like *Asparagus racemosus, Cissus quadrangularis, Terminalia arjuna, Withania somnifera* etc., at the dose of 2 caps twice daily were given to 25 participants for 3 months. After 3 months of treatment women showed significant improvement in symptoms like hot flushes, palpitation, mood swings, instability, anxiety, night sweating, insomnia and fatigue, etc., (Thawani, et al., 2004)

### 2.4 LITERATURE REVIEW OF *CLITOREA TERNATEA* (LINN)

Studies revealed that the blue parts of the fresh flowers of *Clitorea ternatea* yielded 3 pigments identified as cyanine chloride, kaempeferol and anthocyanin, while only kaempeferol was obtained from the white portion.
Ethanolic extract of *Clitorea ternatea* flowers, significantly lowered the serum sugar level, in experimental diabetic rats. There was inhibition of the enzymes β-galactocidase & α- aglycosidase activity by 55.26 % & 24.8% respectively, but no inhibition was observed in β-D-fructocidase enzyme (Sharma A.K., et al, 1991).

Anti microbial activity of a novel flavonol glycoside isolated from the ethyl acetate fraction of *Clitoria ternatea* root, defatted seeds with m.p.- 260°C - 261°C, molecular formula C_{33} H_{40}O_{20}. It was characterized as 3,5,4′ Trihydroxy-7-methoxy flavonol-3-O-α-L-xylopyranosyl (1 to 3)-O-β-galacto pyronosyl (1 to 6)-0-β-D-glucopyranoside ( Yadava R.N., et al, 2003).

The hypoglycemic effect of the methanol extract of *Clitoria ternatea* roots was studied in normal and diabetic rats. The glucose lowering efficacy of the extract both in normal and streptozotocin induced diabetic rats was significant at the doses 200, 400mg. /kg orally, compared to the standard drug glibenclamide at 10mg. /kg. (Mandal, S.C., et al., 2003)

2.5 LITERATURE REVIEW OF AMORPHOPHYLLUS CAMPANULATUS (DENNSST)

Studies revealed that the effect of purified starch obtained from the commonly consumed eight tubers, including *Amorphophyllus campanulatus* on the metabolism of lipid was studied in rats fed atherogenic diet. Maximum lipid levels in most cases were observed with sucrose and minimum with glucose. The different tuber starches showed values between those of sucrose and wheat on one side and glucose on the other. Among the tuber starches studied, those from *M. arundinacacea, I. batatas, D. alata and D. esculenta* caused low concentration of cholesterol in the tissues including aorta and heart. (Prema,P., et al., 1978)
Among the 22 tubers and 9 pulses screened, 12 tubers including *Amorphophyllum campanulatus* exhibited Enterokinase activity. (Bhat, P.G. et al., 1982)

Studies were carried out on some genera of family Araceae, present in Indonesia, including *Amorphophyllum campanulatus*, which are used as source of carbohydrate, also some of them used as traditional herbs. Some side effects in human beings were shown due to the presence of raphides and sapotoxins in these plants. (Roemantyo, 1981)

A number of plants were studied for lectin activity: *Allium cepa, A.sativum, Zingiber officinale, Daucus carota, Colocasia antiquorum, Beta vulgaris, Ariopsis peltata, Ipomoea batatas, Amorphophyllum campanulatus* showed considerable lectin activity (Shet, M.S., et al., 1989)

### 2.6 LITERATURE REVIEW OF ANTHELMINTICS

Research was carried out for obtaining the scientific data about heartworm preventive drugs for incorporation. The disease, heartworm, is so named because the adult worms live in the right side of the heart. It is spread by the common mosquito and is found anywhere in the world where mosquitoes breed. The prevention and treatment drugs used for heart worm disease were diethyl carbamazine citrate, ivermectin and milbemycine oxime. (Elsa, S., 1996)

A combination of ivermectin (IVM) and albendazole (ABZ) was screened for chemoprophylactic treatment and for secondary *hydatidosis* is described for the first time. IVM treatment alone was not effective against *Echinococcus granulosus*, either when the protoscolices were recently inoculated or when they had developed to the *metacestode* stage. However, the efficacy of IVM and ABZ when used in combination as a prophylactic treatment was 95.72% and 87% with respect to the number and the wet weight of cysts, respectively. These results were higher than in the treatment of
secondary hydatidosis, which were 44.8% and 45.26%, respectively. The ultrastructural changes in the germinal layer of the cysts after the treatments were also described. (Moreno, M.J., et al., 2002)

Effects on the treatment of hookworm infection with the use of modern broad-spectrum anthelmintics were safe, simple and inexpensive. An essential goal of therapy is to treat any associated under nutrition (especially anemia) with haematinics, including iron and (during the childbearing years and childhood) foliates vitamin A, vitamin B12, iodine, and possibly zinc. (Stephenson, L.S., 2003)

*Trichinella spiralis* treatment with vimang or mangiferin (500 or 50 mg per kg body weight per day, respectively) throughout the parasite life cycle led to a significant decline in the number of parasite larvae encysted in the musculature; however, no treatment was effective against adults in the gut. Treatment with vimang or mangiferin likewise led to a significant decline in serum levels of specific antitrichinella IgE, throughout the parasite life cycle (Garcia, D., et al.,)

Studies were carried out for intestinal helminthiasis and urinary schistosomiasis in six villages, Ogun state, Nigeria. Faecal samples from 199 subjects were examined using direct smear and brine concentration methods. Urine samples were tested for haematuria and proteinuria using diagnostic reagent strips. Three helminthic parasites were identified in the faecal samples;

*Ascaris lumbricoides* (62.8%), hookworm (16.6%) and *Schistosoma haematobium* (2.5%). None of the parasites was sex-dependent. *A. lumbricoides* had 50% prevalence in all the age groups. The more common mixed infection was *A. lumbricoides* and hookworm. (Agbolade, O.M., et al., 2003)

It was revealed that blood feeding hookworms, which currently infect over a billion people in the developing world, are a leading cause of gastrointestinal haemorrhage and iron deficiency anemia. (Harrison, L.M., et al.,)